

Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

Coloured covers/
Couverture de couleur

Coloured pages/
Pages de couleur

Covers damaged/
Couverture endommagée

Pages damaged/
Pages endommagées

Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée

Pages restored and/or laminated/
Pages restaurées et/ou pelliculées

Cover title missing/
Le titre de couverture manque

Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées

Coloured maps/
Cartes géographiques en couleur

Pages detached/
Pages détachées

Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)

Showthrough/
Transparence

Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur

Quality of print varies/
Qualité inégale de l'impression

Bound with other material/
Relié avec d'autres documents

Continuous pagination/
Pagination continue

Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure

Includes index(es)/
Comprend un (des) index

Title on header taken from: /
Le titre de l'en-tête provient:

Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

Title page of issue/
Page de titre de la livraison

Caption of issue/
Titre de départ de la livraison

Masthead/
Générique (périodiques) de la livraison

Additional comments: /
Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below /
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>									

V. P. JOURNAL

VOL. I.]

APRIL, 1884.

[No. 7.

NOTES.

MORN.—

But, look, the morn in russet mantle clad,
Walks o'er the dew of yon high eastern hill.

—*Shakespeare.*

Morn in the white wake of the morning star
Came furrowing all the orient into gold.

—*Tennyson.*

I stood upon the hills, when heaven's wide arch
Was glorious with the sun's returning march,
And woods were brightened, and soft gales
Went forth to kiss the sun-clad vales.

—*Longfellow.*

LITTLE THINGS.—

“Not alone in trees and flowers
The spirit bright of beauty dwells;
And not alone in lofty towers
The mighty hand of God is seen :
But more triumphant still in things men count as mean.”

“In one word, know this, that the humblest and meanest products of nature are those from which the sublimest properties are to be drawn.”—*Lytton.*

HEARING.—Lytton in “Zanoni,” his wonderful work of idealistic, mystical, almost supernatural fiction, has thrown out a thought that will impress itself more and more, that will arouse new ideas, and perhaps demand an attention and assent not at first accorded: “For there is a sense of hearing that the vulgar know not, and the voices of the dead breathe soft and frequent to those who can unite the memory with the faith.”

MUSIC.—George Eliot asks : “ Is it any weakness, pray, to be wrought on by exquisite music ? to feel its wondrous harmonies searching the subtlest windings of your soul, the delicate fibres of life where no memory can penetrate, and binding together your whole being, past and present, in one unspeakable vibration ; melting you in one moment with all the tenderness, all the love, that has been scattered through the toilsome years ; concentrating in one emotion of heroic courage or resignation all the hard-learned lessons of self-renouncing sympathy, blending your present joy with past sorrow, and your present sorrow with all your past joy ? ”

WE commend to all our readers a careful perusal of the article in another column on “ Convocations.” It has been written more particularly for Victorian alumni, but the arguments apply to the alumni of all Canadian universities. If the alumni do not show loyalty, where shall we look for it ? May Toronto, Queen’s, Trinity, McGill, Victoria and all the other institutions, have this year gatherings which, for size, enthusiasm and practical results, shall surpass all former years.

LOCALS.—“ Fools rush in where angels fear to tread. Nevertheless, we venture to intrude our presence upon a ladies’ *sanctum*, and enter our criticism upon some of the senseless trash that at times fills the columns of some American Ladies’ College Journals. Coming nearer home, however, we are astounded by such impenetrable jokes as ;—! !—? ; How ? etc., etc In seven lines we find nine words, eight quotation couplets, five exclamation marks and four interrogation marks. One would gain the impression that some young ladies are made up of interrogations and exclamations ! ! ? ?

CANADA’S FORESTS.—There is agitation from time to time on this question, and reasonably so. The Local and Dominion Parliaments should, without delay, not only change the free

grant land conditions, but enact concerning the old settled farms of Ontario and the other Provinces. No farm should be allowed to be stripped of more than ninety per cent. of its woods. There should be at least ten acres of woodland on every one hundred acres. Why wait? Why not act now? The time is coming when the legislators will be forced to act.

LONGITUDES.—The International Geodetic Association, recently held at Rome, have recommended the unification of longitudes and of time by the adoption of the same standards for all nations. The initial meridian selected by the conference is that of Greenwich. The cosmopolitan time is also to be that of Greenwich, and the hours are to be reckoned from 0 to 24.

LIGHT.—“If an intelligent being had an eye so keen that he could see the smallest object by the faintest light, and a movement so rapid that he could pass from one bound of the stellar system to the other in a few years, then, by viewing the earth from a distance much less than that of the farthest star, he would see it by light which left it several thousand years before. By simply watching, he would see the whole drama of human history acted over again, except where the actions had been hidden by clouds, or under other obstacles to the radiation of light. The light from every human action performed under a clear sky is still pursuing its course among the stars, and it needs only the powers we have mentioned to place a being in front of the ray and let him see the action again.”—*Newcomb*.

INSECTS ON POLISHED SURFACES.—Dr. Dewitz thinks that the hairs of the feet emit a fluid by means of which the insects are enabled to adhere to vertical glass surfaces. This is the opinion of the greater part of entomologists, who deem that the adhesion is due to the viscosity of this liquid. Dr. J. E. Rombouts has recently shown in an interesting work that this last view is not correct. He gathered and examined

little drops of the fluid, and observed that it is not a slimy but a decidedly liquid and oily substance. He therefore concluded that the adherence is not due to *viscosity*, but to *capillarity*, that is, molecular attraction between liquid and solid bodies. In his opinion the adhesion of flies on glass is produced by the action that each little drop exercises on the hair which emits it. In order to prove this theory Dr. Rombouts made numerous experiments on capillary attraction, and came to the conclusion that the molecular action between the fluid and the hairs of a fly can bear up a weight of 0.69 grains, whereas the average weight of a fly is 0.49 grains. He also found that the attraction is sufficient to enable flies to remain on a vertical surface, even were ordinary water substituted for the emitted fluid.—*Acadian Scientist*.

FASHIONS.—Fashion's freaks and fancies, in all their intricacies, advantages and absurdities, are beyond the power of our explanation. Whether the survival of the fittest will explain the evolution of the modern apparel of some society individuals or not, we do not intend to discuss; but evolution—that *dernier ressort* of scientists—will explain anything and everything in the hands of the ingenious. Some day, when you have nothing better with which to amuse your mathematical propensities, sit down and calculate the amount of time, money, etc., wasted by newspaper writers and readers over silly paragraphs (omitting this) on the modern *dude*. Then calculate the number of other similar trifles, and make an estimate of the time the world spends, loses, wastes over useless, profitless, not to mention harmful, trifles. We fear the results upon our own mind of such a calculation, and leave it to other triflers. There are, however, scientific principles underlying many of the fashions of the day, and a careful study of the nature of colors, the harmony of shades, the effect of light, etc., would add much to the appearance of ladies, to say nothing of men. Let us take an example. Persons look larger in light clothes than in dark, and a black dress contributes to an elegant figure. The fact may be

explained as the effect of what is termed *irradiation*. Black objects give out *no* light, colored objects reflect the light. The constitution of the eye is such that objects emitting light appear larger than they really are, and a small fringe of colors is observed around light objects. A white ball on a black background will appear larger than a black ball of the same size on a white background. Dark shoes will appear smaller than white shoes of the same size. White light is composed of many rays, all of which in passing into the eye are not refracted similarly, and hence there is not a perfect convergence of the rays of light; an image is formed, but surrounded with a faint colored fringe of light.

DELICACY OF TOUCH.—The power or sense of touch differs for individuals, and in the same individual is developed unequally in all parts of the body. To the curious and observant we submit the experiment of Weber, who determined the delicacy of touch by a simple and ingenious method. "Two persons are required for this experiment, one of whom tests the sense of touch of the other. For this purpose a pair of compasses are taken, whose points, somewhat blunted, are placed at a certain distance from one another on a part of the skin of the other person. The latter must then say, with closed eyes, whether he feels the contact of two separate points, or whether both points seem to be merged into one." Many delusions will result. If the compasses be drawn over the skin from a locality of dull sensation to one of sensitiveness, the compasses will appear to diverge. Many other interesting phenomena will be observed during the experiments. The tip of the tongue is the most sensitive, distinguishing a separation of $\cdot 0394$ inch; then come the finger-tips, with $\cdot 079$ inch; the back of the hand, $\cdot 2$ inch; the forearm, $1\cdot 58$ inch. The locality of dullest sensation is the back, where distances of $1\cdot 5$ to 2 inches are unperceived. This delicacy of touch can be developed by practice, and is observed in its highest development in blind persons, who use the sense of touch to replace their sight.

DYNAMITE.—This is the dynamitic era. The under-currents of society are becoming more agitated, disturbed and violent. Discontent leads to disorder, disorder to devilment, and devilment to dynamite. This plaything of destructionists is becoming the most terrible object to the world. Its hidden power, held in check by the slightest bonds, seems to add a charm to the defiant socialist, whose travelling outfit is no longer a change of clothes for himself, but a satchel of dynamite to be carelessly forgotten in some great public resort. Whether dynamite and the other similar explosives be used for man's assistance or for man's destruction, the same scientific principles underlie the phenomena. The different chemical elements possess for one another different affinities, those uniting which have the strongest affinity for each other. If two elements that have a strong affinity be separated, they will strain to unite. So it is in explosives; elements that have most powerful affinities are by composition brought into the same mixture, but separated by some other element in such a manner that the attractive force is overcome, but nothing more. The slightest touch will drive these two elements into a mutual embrace; concussion will ensue, pre-existing ties will be snapped, heat generated, and tremendous power and destructive force evolved. How to counteract this terrible agent, to prevent universal destruction, is a most perplexing question to scientists and officials. A correspondent in a late issue of the *Toronto World* makes a suggestion: "It is clear that the men who are using it secretly understand it better than the executive and the general public. Surely, therefore, it is high time for teachers of practical science to turn all the light they can upon this subject, and to instruct the public as to its nature. I beg to suggest that gentlemen of the civil service, who are of a scientific turn of mind, make this matter an object of special study for the future, in preference to other subjects. The public has a special right to expect from this class, whom it supports in comfortable livings free from the ordinary wear and tear of bread-winning, a study of what is needful to secure the safety of the common-

wealth, of which they form so privileged a part." The service would certainly be thinned out. The Government would be relieved to some extent from begging partisans. Experiments would be removed from European courts to the civil service offices. What depths of meaning are buried in words—discontent, disorder, disturbance, destruction, despair, devilment, doom, dynamite, death, damnation!

QUERIES.

Why do flickering flames irritate the eye?

When light falls upon the eye, the eye must be adjusted to receive that light, and a difference of color or intensity requires a difference of adjustment. Thus if the light is not steady the eye is constantly agitated or irritated to accommodate itself to the various degrees of intensity of the light. The eye returns to rest as the light diminishes, when the return of the bright light arouses it again. A steady light however requires a constant adjustment, and hence the irritation ceases soon after the first appearance of the light. We are slightly pained in the morning on opening the eyes, but the constant steady sunlight soon becomes a pleasurable sensation to the eye adjusted to receive it.

How are distances measured by the eyes? Why are *two* eyes necessary?

Close one eye and look at an object whose size and distance you do not know. The object appears to you to be in a certain *direction*, but as to its *distance* you are not sure. If the object appears large you imagine it to be near, if small, far away. Now close this eye and look at the same object with the other eye. The object will now appear to lie in a slightly different direction, *i.e.* the lines joining your two eyes with the object will not be the same, or even parallel. If now you look at the object with both eyes, you will have two images coming from the same object through the two eyes united in the brain. The directions in which

these two images come to the eye are different; they may be represented by straight lines coming from the object to the eyes. The object cannot be in two places, but it lies in two straight lines, hence it must lie at the point where these lines cross, making an angle. If this angle be large we know the object must be near, if the angle be small the object must be far away. Thus the distance will depend upon the angle, and this angle we are able to calculate, since we have a clear idea of the directions of the lines making the angle. We are able, however, to appreciate this angle only within certain limits; the images coming from a star to both eyes are so nearly parallel in direction that we cannot observe the angle, and hence can tell nothing of the distance travelled. The two eyes also enable us to see an object from two points at the same time, hence give us a more comprehensive view than would be the case in monocular vision. The principle of binocular vision is made use of in finding the distance of distant objects; the direction of the object from two points are found, the angle included calculated, and the distance mathematically determined.

WHAT is the absolute unit of measurement?

This question was asked some time ago in the V. P. JOURNAL. Since then we have been thinking over the query. An answer arrived at last. We give it, and may humbly claim that it is good. From another it might not be so valuable.

The question assumes that there is "an absolute unit of measurement." Philosophically this is an absolute necessity, but practically it is not within the reach of man. The simple units of measurement are those pertaining to *time*, *space*, *distance* and *weight*. If so minded, *value* could be included, but as it is sure to involve disputation, we pass it for the present.

Now for our measuring unit. This unit is the *ultimate* of matter; by ultimate we mean the smallest possible portion of existent matter.

Since it is the smallest there can be no trouble in seeing that its *volume* becomes a *space unit* of all space occupied or not.

Its motion—vibratory—is the slightest possible movement, and therefore a unit of all motion.

Its weight is the lightest possible, and therefore a unit of all weight.

The time of its vibration is the shortest possible, and therefore a unit of all duration.

By unit is meant an absolute factor, so that all space, distance, time and weight will exactly contain and be fully measured by its proper element of measurement. This is the groundwork of what may follow at any moment. X.

A RECENT AURORA.

THE night of the 28th of March was illumined by probably the finest auroral display of the year. Between 9 and 10 a bright, clearly defined bow of light spanned the sky a few degrees south of the zenith. Pulsations traversed it like those made by passing electricity through a Geissler's tube. After a time the bow disappeared and the auroral activity to the north grew more intense. Curtain-like tissues of light, tinged with delicate green or crimson, shifted and changed their downy folds with a throbbing, upward-darting motion. The spirits of the north marched their airy battalions through mid atmosphere to storm the very zenith. It was a very beautiful sight.

The display was, no doubt, accompanied by a heavy magnetic storm, and both find their cause in solar disturbances.

The tremendous, world-engulfing cyclones of the sun have their faint echo in our own atmosphere in the swift regiments of phantoms whose pale forms gleam in the northern sky. What a subtle unity runs through the whole vast system, when a solar tempest can arouse, 93,000,000 miles away, a

magnetic storm and the auroral streamers! And did not the electric tremor which lighted up our atmosphere speed on to every wandering globe of the system, till far off Uranus and Neptune glowed in sympathy with the storm troubled sun?

The bonds which hold the whirling planets may be intangible—yes, inexplicable, but they are not less real and powerful than bands of steel. The universe is one. The seeming void of space is all a-quiver with messages from one world or sun to another.

FENCES.

NATIONS might be classified as fenced and unfenced, and these two grand divisions might be subdivided according to the kind of fences built and the reasons for building them. There is more philosophy in the matter than would appear at first sight.

No country in the world contains more charming rural scenery than England and Wales, and no country in the world does more to hide its landscape treasures from the passer. A walking tour is half spoiled by the blank, exclusive stone walls that would fain shut in the dusty wayfarer to his dusty road. Anyone who has made a foot tour through Wales—that exquisite pocket edition of mountain scenery—will remember his impatience as the blind and impassive stone wall everywhere met him just when the view should have been finest. What a glorious picture of flowery meadow dotted with sheep, of purple moorland and blue mountains, that trim but ugly wall cut off from his retina! English stone walls are certainly malicious, but English hedgerows—rich with green and starred with flowers—are a delight to beauty-loving eyes. They sprawl over a wide space, it is true, and waste almost a quarter of the trim garden-plot fields but they are charmingly picturesque. One would think, however, that overcrowded England had no land to waste on the merely picturesque.

If you take ship over to Rotterdam, and enter Europe thence by rail, you find yourself gliding through some of the most level and most perfectly cultivated lands of the world. There is an endless succession of little patches and strips of the richest velvet carpet, mostly green. What a desecration to let those lazy cattle loll and browse on it! They will certainly soil the velvet! No fences here. The half amphibious Dutchman, if he cannot bring the sea with him inland, can at least lead in a canal, and that he does. Every square of velvet has its limits set by a ditch dug with great deliberateness and exactitude, into which flows a branch of some sluggish stream and reposes in true Dutch serenity of satisfaction as a canal, on which boats containing grass, and roots and manure, may be towed after the good old Dutch fashion. Whether the canals have caught the Dutch phlegm, or the Dutchman has, by ages of admiring contemplation, imbibed the muddy tranquillity of his canals, is a question not easily solved.

When you reach Germany, you find as a rule, in the country parts at least, neither fences nor canals. A footpath or a shallow ditch, or even a boundary stone here and there, satisfies the philosophic German mind as to the bounds of his property. Were not governments established to secure to him his rights? Why then should he waste time building stone walls or board fences?

In many parts of Austria, too, fences are not to be found, though as one approaches the Mediterranean regions stone walls of the most aggravated type show themselves. The vicinity of Trieste presents some of the finest scenery of the Mediterranean, but, alas! so cut up and shut up by stone walls on each side of the narrow, crooked lanes that barely glimpses, entrancing but unsatisfying, can be obtained. The ugliness of the walls is, however, redeemed by overhanging vines and boughs of fig or orange trees.

Just so in Italy, at least in the southern parts. Unless you follow the main roads, the view is generally cut off by envious stone walls. If you take a by-path from Resina to

ascend Vesuvius, you find yourself in a perfect labyrinth of narrow, steep lanes, so walled in that only now and then the smoke-crowned summit of the volcano can be seen as a kind of beacon.

If we now cross the Atlantic to America, we find all extremes, from no fences in some of the prairie states to the ugliest and most forbidding barriers that man has hitherto conceived and executed.

Nothing more barbarous than a Canadian stump fence can be imagined. The unsightly, sinuous, rickety rail fence formerly all-pervading, finds its rule on the wane. Board fences and picket fences, if also ugly, are comparatively neat and trim, and take up no more room than necessary. The barbed wire fence is, perhaps, the most shocking of modern inventions for excluding outsiders and including one's own.

The reasons for fence-building are various. The Englishman seems to think his acres are his own to the very air and wild flowers and sky, and he builds stone walls so that no one shall invade his privacy by so much as a look. Perhaps the keen competition for land in so narrow an island has given rise to this exaggerated feeling of exclusive possession. Beautiful things ought not to be shut up out of sight of the great world hungering for beauty, so that the owner may gloat over them in secret. This offensive exclusiveness shown by English land-owners will help to foster in the minds of the masses Henry George's doctrines of confiscation.

In Italy walls are high and capped with prickly cactus, because property is insecure and every passer is supposably a thief.

In Canada we fence—why? So that the roads may drift full in winter? Or so that the hired men shall have plenty to do? Or is it because we like to fence? Our very idea of fencing is founded on injustice. Because I keep cattle, therefore every other man shall spend hundreds of dollars in fencing them out of his grain. If my neighbor's fence is not high enough the law gives him no redress when my cattle trespass.

All this is most unwise. The owner of cattle is the proper party to keep them out of mischief. If all men were compelled to *keep in* their own animals instead of obliging all other men to keep them out, an injustice would be removed, and an almost incalculable saving would be effected here in Ontario. Probably most Ontarian farms have more capital invested in fences than in houses and barns. A suitable law, obliging owners to fence in or herd their stock, would relieve the Province of a tax of millions of dollars per annum now spent needlessly on fences.

Close fences may do in tiny England, but to import the same expensive and exclusive methods into a democratic country like Canada, with an area equal to all Europe, and a population of only 5,000,000, is the extreme of folly. More than one country in Europe and several States in America do without fences; and why should we not imitate their sensible example?

ELEMENTARY SCIENCE IN OUR SCHOOLS.

IN urging the introduction of elementary science into our schools, it is not assumed that every pupil in them is qualified or should be compelled to engage in the study. Far from it. But what I do say is that those pupils who exhibit a taste for any of the various subjects—say of natural history, elementary science, or practical mechanics—should have an opportunity in our Public or High Schools of learning something about them.

In an address by Mr. Gladstone on this subject, he stated that “the boys of the English schools (and it is so in our schools) had not yet had fair play in the study of elementary science and natural history.” An eminent English professor (Huxley) says truly that “nothing more than the rudiments of science and art training can be introduced into elementary schools. This is all that I propose, or that is desirable. But the introduction of these subjects should take place at an

early date, and should be practically made." Sir John Lubbock has, with great zeal and discretion, sought year after year to induce the House of Commons to agree to the introduction of these subjects into the English elementary schools. In this he is ably seconded by Dr. (now Sir) Lyon Playfair and other popular scientists, and lately by Mr. W. E. Forster, formerly and practically the Minister of Education in England, and an able educationist and statesman. His idea is "to make education less bookish, and to let the boys and girls have a chance of being taught something about the properties of things in the world around them. He has had great difficulty (as we all experience) in convincing people that the elements of natural science are really much simpler and more intelligible to the minds of children than much of the book learning that is sedulously dinned into their ears at school."

So long as our system of schools was in its infancy, all that we might be fairly required to do was to confine our efforts to mere elementary subjects, and in the end to be content with very moderate results. Experience has shown, however, that without great care and constant effort, the tendency of all systems of education is to a state of equilibrium, if not to silent retrogression, or, at best, to a uniform dead level of passable respectability.

Those in this country who have carefully studied this subject in all its bearings, and have looked closely into the educational history and progress of other countries, know full well that our school system, if left where it is now, must fall behind that of other nations, and consequently fail in its objects. It must therefore embody within itself—as elements of strength and progress—the living principle of growth and expansion. And in order to ensure permanence and progress, it must provide fully for the educational wants of the entire youth of the land.

But, even on the part of intelligent men, opposition is constantly directed against the introduction of natural history and elementary science into our Public Schools. They are decried as unnecessary and useless. Consequently thousands

of pupils are leaving our Public Schools every year who are practically ignorant of even those simple principles of elementary science which are illustrated in the industrial and agricultural appliances with which they are familiar in the workshop and on the farm. Take one in twenty of these pupils in our rural schools and ask him to give you a correct explanation of the principle of the threshing machine, fanning mill, reaper, the mechanical powers, railway locomotive, or the thousand and one adaptations of science to industry which he daily sees, and he will admit that he knows little or nothing about the principles of science which they illustrate. And in very many cases he will as frankly tell you that he never even heard any explanation of them. How can it be otherwise when the great majority of our teachers have only a superficial knowledge of some of the subjects themselves? Of the 6,928 teachers employed in the Public Schools of Ontario in 1882, no less than 4,353 held certificates of the very lowest grade authorized by law, and but 1,970 held second-class certificates of all grades; while only 258 held first-class certificates.

Speaking of "shallow" education, the late State Superintendent of Education in Pennsylvania thus illustrates the great loss which the country sustains by the mere "read, write and cipher" system which so many hold to be quite sufficient for our schools. He says:

"Many of our people seem to think that if they have their children taught simply to 'read, write and cipher,' it is enough. Others add to these branches a smattering of geography and grammar, and call that *education*. Superficial education of this kind is breeding among our people shallowness, rawness, conceit, instability, and a want of self-respect, honor and dignity. It is lowering the tone of society, subjecting us to the rule of unprincipled demagogues, filling high positions with incompetent men, and weakening public virtue. Every social interest and every governmental concern in the United States is suffering for want of men of broad views, ripe culture and high sense of right."

President Porter, of Yale College, in his inaugural address said:

“In a country like the United States, wealthy, proud and self-confident as it is, there can be neither permanence nor dignity if the best knowledge and the highest culture do not influence its population and institutions.”

In a further paper I may instance what some other nations are doing in this matter. The subject is a large and practical one.

J. GEORGE HODGINS.

Toronto, 2nd April, 1884.

THE SCHOOL SYSTEM OF ONTARIO.

WHERE is the basis of the present school system? Have we any well known and definite foundation? Or are we living, and sustaining the present fabric simply because it cannot be killed? It is one of the necessities of our life, and must live even if it is without a proper basis, and in its sickened state almost dosed to death. For many years fresh drugs, pills and plasters, have been applied with varying and doubtful success. But the time has arrived when the whole of our present machinery must be laid aside; not so mild—thrown out forever.

Is the educational system managed by the Legislature, or the Minister of Education, or the teachers, trustees, parents, pupils, or by all together? We hesitate not to say that it is managed too much by all and not enough by any. Some think and say that the Educational Department manages the whole affair through the Minister, the two High School Inspectors, and the Public School Inspectors. True, these gentlemen are hard at work and doing all they can. But they are working with a sick, very sick old man. Let the death of oblivion overtake the patient and carry it from our midst.

As the matter stands to-day, the Minister of Education is part of a party machine, whereas he should be as independent as the judges. He should hold the position for life, with very definite limitations assigned him by the Legislature.

The teacher of to-day is, for the most part, a consciously dependent man. He realizes that he depends upon the *ipse dixit* of a few men—called the School Board—mostly illiterate, and inexperienced in school work. How seldom the best educated men of the community are found on the Board! Small salaries, rather than high educational and moral qualifications, are at a premium. The teachers of Ontario know that they are not paid properly for their services. They also know that the present system will never bring them suitable remuneration. Not one teacher in a thousand ever becomes wealthy at his calling. Not one in a hundred secures from the profession, in a period of twenty-five years, enough for a plain and comfortable living. Spirited men who are able to leave the profession, in disgust do so at the first opportunity. About 400 left the calling last year. Many who are teaching now are only using this plan as a means to a more honorable and lucrative profession. They early learn to despise the denominational narrowness and persecution. They grow tired of being tongue-tied on the important question of legislation in its relation to their country.

They may talk arithmetic and grammar to their pupils, but they must keep their mouths shut on politics and religion. Out of the school room they must remember that men around them *may* gossip, theologize and politicize, while it is their personal duty to keep quiet. They may feel strongly, they may keep up a powerful thinking, but they are also to submit to a false, barbarous and most despicable custom—that of being quiet on all occasions of importance.

Let the country be agitated with such questions as a protective tariff, free trade, prohibition of a wholesale-murdering, man-debasing and God-dishonoring whisky trade, church union movements, provincial rights, high-handed, country-cursing bribery, and the teacher in nine cases out of ten must have no mouth. He may talk words, but not ideas. If so, he will soon learn that members of the Board of Education are on his track; religious zealots or political fanatics, or whisky-soaked aristocrats and democrats—and, perhaps, alto-

gether—are after him with all the venom and rage which can be called into action.

Is not the teacher better educated than the masses? Has he no intellectual acumen? Is he ignorant of the highest kind of legislation? Does he not legislate for the pupils who are often wrongly taught at home? If of necessity he must legislate for the highest interests of the pupils, and therefore for future generations, why should he, by the custom of the profession, be excluded from taking part in discussing and agitating governmental legislation!

The answer is at hand. He is too easily thrown out of a living; and he knows there are narrow-minded men who will on the first occasion use their power to send him adrift. It is easily done—*only a vote or two*—and all is over. The result is that in the eyes of the world the teacher is only a feeble poltroon, and only tolerated because he is an educational necessity.

The average teacher of to-day is not respected for his position, as the minister, doctor, lawyer and successful business man. In his work he may have as eminent success as any other man—minus the finances, of course; all the morality—and he *must* have a good share; all the practical legislative power to rule the host of spoiled children, ranging from *five* years of age up to *twenty-five*; all the religion of the most sainted—but he must not teach it in school; and after all, he is only accepted as a necessity and with reluctance. His salary must be low, and then his qualifications must be good, or accept another \$25 less. If he does accept the less, he must then be as nearly perfect as possible.

But where is the remedy? Who will move in the matter? Will philanthropists? Not a bit of it. Their work is to help the idle sot, the miserable tramp, the drunken, brutal wife-beater, and the sneaking midnight thief. Will the doctor? No! His work is to administer pills, apply plasters, and saw off legs, doing his work *gratis* for the sluggard, indolent and worthless, while he makes the honest teacher pay the piper. Will the minister? Not he. His work is to save sinners,

and call upon the teachers to help him in this grand salutary work. Will the lawyer? Yes; if he is willing to go to law for the sake of a portion of his salary, which has been kept back most unjustly on some frivolous pretence. Not otherwise. Will the legislator? Not much. However, he is willing to dabble at the wretched old system. His aim no doubt is to help someone or something; he does not care much, so long as he is one of the legislators who work up "our grand system of education."

A radical change is badly needed. In my next, a "New System," like Minister Pedley's "New Theology," will be submitted. X.

DREAMS.

"A dream itself is but a shadow."—*Shakespeare.*

IF a dream is a shadow, what is the substance? If we can find the substance, where shall we look for the light that casts the images and outlines the shadows upon the background? The screen or background is the mind; the image is the thought; the shadow is the dream; the substance is reality or existence; the light is the all-pervading, universal, varied motion of sound and light, the foundation of existence, the groundwork of knowledge, the life of creation—emanations from the Creator or Source of light and being.

The "airy nothingness" of dreams but adds to their interest. The weirdness, mysticism, and intangibility of dreams have woven a web of mystery, attraction, fascination and superstition that we do not pretend to unravel. We admit our fascination and have often tried to outline the design, to follow the colors, to reveal the texture; but study has but added to our mystery and wonder. There are many colors interwoven; if we cannot comprehend the full meaning and plan of the design, we may perhaps gradually work out and follow one by one the brighter-colored threads.

The subject may be approached from two sides, the

spiritualistic and the materialistic. We have just read an article on "apparitions" by the Bishop of Carlisle, in which he deals with this subject from the mental, intellectual or spiritualistic side. This has suggested to us a consideration from the opposite, the materialistic side. Do not, however, from this conclude that we are materialistic in our views: we believe in the unseen more confidently than in the seen. The two worlds, mind and matter, are most intimately connected, and in a subject of this nature they must both be considered. Let us consider this subject from the side of matter, and this side from one stand-point, making use of an analogy to throw light and outline upon this indefinite something.

Every thought or feeling of the mind affects the brain; motion or energy in the brain results, sometimes even affecting the muscles and limbs. The workings of the mental or spiritual nature may therefore push themselves so prominently into consciousness that we will have clear images, connected thought, intelligent dreaming. This is the effect from within. Now from without. Here let us introduce our analogy—or what may be only partially an analogy—the sense of sight and some of its phenomena. The eye is affected, set in vibration, by the entrance of light, which in its decomposition consists of the seven colors—red, orange, yellow, green, blue, indigo and violet. You see a falling star leaving behind a train of fire; you whirl a red hot iron, leaving the impression of a perfect circle. The explanation is that the impressions of the light last for an appreciable time after the disappearance of the cause; the wind blows over the lake and dies away, but the waves and billows last long after the cause has ceased. The images of objects, sights, sounds, outlines, touches, motions, have been filtering into our brain all day long; the nerves have been for hours in constant vibration; night comes on; sleep is sought; the cause shut out, but the effect outlasts the cause; the wind has died away, but it takes perhaps eight hours for the wavelets of sensation, the vibrations of the nerves, the activities or origins of thought, to lull themselves to rest. The vibrations of the day have affected the brain, arousing a

set of thoughts which the will has marshalled into form and order. The reflex vibrations, similar to those of the day, intermingled it may be, less violent, gradually disappearing, again at night affect the brain, arouse again the thoughts of the day in a disordered manner (since the will is inactive), and the business cares and thoughts of the day, grotesque or serious, dim or distinct, will be the substance of our dreams. The actions of the day will be the substance, the dreams the shadow.

Dreaming under these conditions would be the subsidence of the sensory system, the return of the mind and body to its normal condition, the rearrangement of the parts prior to the actions of the coming day. But our dreams do not always harmonize or follow the actions of our waking moments. How often we have dreamt the opposite of our day thoughts. Dreams go by contraries, say some superstitious persons. Our incidental images, as the scientist terms the above, are not always positive; but if the eye be wearied with an object, the image will be negative. You observe closely for a length of time a white star on a black page, then turn your eye away and you will observe a black star on a white page. The explanation is that the retina is fatigued at the spots where the light has acted strongly, the other parts are fresh and more sensitive, and when the eye is turned away, by over exertion the parts before affected are unaffected now: where white was now is black. So by analogy the overwork of the day may cause the active parts in the brain to be replaced by blanks, the inactive parts to be replaced by active (in contrast with the other parts), and the result will be that the dreams and the day thoughts or activities will be opposite. If the eye has been wearied by a primary color, the complementary color will most easily affect it; thus, a red star will leave on the eye the after-impression or incidental image of a blue. The day thoughts may not be followed by opposite dreams, but by complementary dreams, if the analogy is here admissible. The sun's rays are composed of a mixture of the seven colors before mentioned. "If we gaze for a

moment at the sun, very strong incidental images appear which last for some time. They are always colored and frequently change their color. This arises from the fact that the colors of the incidental image of white sunlight do not disappear simultaneously. When one color has faded, the image is no longer white; the remaining colors appear which gradually fade away after many variations." As the wind goes down, the little wavelets riding on the backs of the greater waves subside, the crests become smooth, the billow slowly dies away in the gentle heave of a pulsation that soon loses itself in the calm and quietness of rest. The thoughts do not leave as they came. The undulations and vibrations of the brain and nervous system die away in sleep in a similar manner; they may have entered all together or at different periods, but they disappear in succession, giving rise to a series of sensations and thoughts different entirely from those of the day, as the images of the sun differ in color from the true and first perceived image.

Let us sum up our arguments and draw our conclusions. The mind is the thinking and dreaming agent; the body (brain, nerves and senses) is the abode of the agent. These two are so closely connected that every action of the one affects the other; every thought results in sensory motion; every sensory motion results in thought, conscious or unconscious. During the day the senses are constantly pouring into the brain sensations or motions of various kinds. During sleep the entrance gates are closed, and the much-disturbed and agitated brain and nerves slowly and gradually return to their normal state of rest, quiet and receptivity. This return to normal condition is dependent upon and due to the activities of the day, but the mode of return, and the sensations resulting, may or may not correspond with the previous sensations. These sensations are allowed to come to rest of their own accord, uncontrolled almost altogether by our will; the brain affects the mind and the dream results. Different persons are differently constituted as to their senses, their nerves and their sensitiveness. To some these sensations

may be very clear and disturbing, to others they may not arouse the consciousness at all. When we have found something of the state of consciousness, we may still expect to have before us the more mysterious depths of unconscious thought and action; we may now perhaps view the winged thoughts that flit before our consciousness, but we will still be ignorant of the true home and abode of these mystic, fairy creatures. We have tried to find one clue, but there are so many others, and it is so easy to delude one's self in such an uncertain search. If dreams are the reflex of the day thoughts, what will be the reflex of our life thoughts?

“Dreams double life;

They are the heart's bright shadow on life's flood;
And even the step from death to deathlessness—
From this earth's gross existence unto heaven—
Can scarce be more than from the harsh hot day
To sleep's soft scenes—the moonlight of the mind.”

VICTORIA'S CONVOCATION.

WE hope to see at Convocation this year a large attendance of old students, friends and graduates of Victoria University. Our students are men who, as a rule, honestly endeavor to make all that can be made out of the stuff. Some are compelled to fashion their own tools for the work, so far at least as to have to earn the money necessary to secure an education. The lack of funds compel some to forego residence for a time. They leave college determined not to fall behind their classes. But solitary study is wearisome work; money comes slowly in; desire fails, and only those of strong determination carry out their original purpose. But the student who returns yearly to Convocation seldom fails to take his degree. We know a student who left college at the close of his sophomore year. He had firmly resolved to return after spending two years in the ministry. But year after year passed by; “the demands of the work,” etc., etc., were urged,

and one year after ordination found him with no intention of completing the course. The desire itself had almost vanished. At this time he came to Convocation, and his ardor was fired to all its ancient heat. All obstacles were overcome, and in due time he took his degree. We make an earnest appeal to all non-resident students to attend Convocation. The zeal, courage, determination, inspiration and hope they will receive will amply repay the sacrifice of time and money.

The graduate can derive even greater benefit from Convocation than the undergraduate. When a student bids farewell to university halls his work is not done. If he is to amount to anything he must grow, and he cannot grow without constant study. Energetic study alone is not sufficient. One's activity must be rightly directed. Each professor of our university is conversant with the latest discoveries and phases of thought in his department, and more is often learned by a few hours conversation with them than in months of solitary toil. Much valuable time and energy are wasted in studying exploded theories and authors out of date. We have read of a Yankee who cast his vote each polling day for Andrew Jackson (years after "Old Hickory" was laid under the sod). "But," said a bystander, "Andrew Jackson is dead. Why vote for a dead man?" "It does not matter to me," said this constant Democrat, "I vote for Andrew Jackson." We know graduates who study and think, but their meditations are among the tombs. Theories which since their undergraduate days have been followed to their graves, they think of still as living realities. These are the men who do not come to Convocation. A few days intercourse with our professors would transport these men from the dead past to the living present. They would hear of the latest theories and discoveries, and get an idea of the best authors to be studied. Dr. Haanel's discovery in blow-pipe analysis has been lately published in the Proceedings of the Royal Society; but all who visited Faraday Hall last year, heard from Dr. Haanel a full explanation of the use of hydriodic acid as a test, and had leisure to examine Dr. Coleman's illustrations,

thus getting the advantage of the discovery months before it was given to the general public. As our graduates value intellectual life and growth, so let them value their Alma Mater, and attend her yearly Convocations.

The benefits of attendance upon Convocation are not on one side only. The mother herself derives as much advantage as her sons. Not many Convocations since we had the pleasure of receiving, as a visitor, a graduate of the wealthy Provincial University. This gentleman was full of pardonable pride in his own university, and full of unpardonable prejudice against all others. A truly modest man by nature, yet, so far as his own university was concerned, he exhibited by turns a "gay, tail-spreading peacock vanity," and the "slow-stalking, hissing, contentious vanity of the gander." That year there was an unusually large and enthusiastic attendance of graduates, and as he mingled with them his bearing became less confident. Before Convocation week closed he said to us: "I was taught to believe that Victoria University was below contempt—a dying institution, in fact—but a university that commands such enthusiastic affection cannot be contemptible. And such loyalty means vigorous growth and life in the future."

The effect upon our professors is not unworthy of consideration. If ease and wealth were the chief objects sought by our professors, they would not be connected with Victoria University. "The destinies are opulent," says Carlyle, "and send here and there a man into the world to do work for which they do not mean to pay him in money." So far at least the College Board is in harmony with the destinies. The gentlemen who vote the supplies are fortunate in finding men who have a high, heroic idea of work, who make the faithful discharge of duty the first object, and their own personal prosperity the second. To do good work whether they live or die is the motto of our professors. It is to their credit that work first and wages second is their principle of action; it is to the disgrace of the wealthy Methodist community that they are compelled to give such signal proof of

it. This general lack of appreciation may arise largely from not understanding the character and merit of their work, but this excuse cannot be pleaded by our alumni. Our graduates should show by their presence at every Convocation that they remember with affection and respect the men who have done so much toward forming their characters. Such affection and esteem will be considered by them more precious than wealth, more noble than fame.

ORTHOEPIC REFORM.

TO a cultured Englishman there must be something exceedingly irritating in the harsh and slovenly articulation of the average Canadian public speaker. Even the Americans, whose twang we so much despise, complain of our harsh brogue and vowelless words. One American linguist declares he can always detect a Canadian by his *'m* and *th'm* instead of *him* and *them*. Whatever ground there may be for such remarks—and there is too much—every one who has given the subject of orthoëpy even a passing thought, must be painfully sensible of the need of reform in this matter. Our public speakers, who should be models of purity and precision, are inexcusably slovenly and inaccurate in their articulation. Many in whose eyes a misplaced accent, the addition or omission of an initial *h*, or the slightest error in orthography or syntax, is a grievous sin, are continually murdering the Queen's English in the matter of articulation.

Of all the sounds in our language none are more commonly sinned against than the intermediate and Italian sounds of *a*, as in the words *ask* and *psalm*. How many of us would make any distinction in the pronunciation of *ant* the prefix, *ant* and *aunt*? And yet here are three distinct sounds of *a*, viz., the short, the intermediate and the Italian. How many hesitate to give the vowel the same sound in *hat*, *past*, *nut*, *calm*, *band*, *glance*, *basket* and *alms*. Indeed, one is in great danger

of being accused, or at least suspected, of affectation, should he attempt any distinction. It is certainly a pity that the richest, sweetest sounds of our language should give place to the hard, sharp, short sound of the vowel. But so it is.

Another rock of offence to many is the short sound of *o*. The words *often*, *soft*, *lost*, *foreign*, *cough*, *forest*, *fog* and *correct*, are generally pronounced as if spelled with *ow* instead of short *o*. What a shame that a sound so neat and trim should suffer the indignity of being literally turned out of office by that vulgar, full-mouthed, awful usurper.

Again, what are termed the coalescent sounds, such as *ir* and *er*, are seldom correctly articulated. Thus, the words *first*, *bird*, *girl*, *verse*, *mercy* and the like, are pronounced as if written *furst*, *burd*, *gur*, *vrse* and *murecy*. Men can find authority for almost every error, but they will find it difficult to discover any for this.

Then there is that dreadful long *u*. Who has not stumbled over that? Either he gives it the *oo* sound, and talks about *toobs* and *tootors* and *institootions*, or having avoided *Scylla* he falls into *Charybdis*, and we hear him singing dirge-like *tehtunes* to *shuit* another metre, or, having been fortunate to escape both, he unfortunately brings his perfect long *u* into *erulite*, *cherubim* and *Jerusalem*, quite unconscious of the fact that when preceded by *r* it takes the sound of *oo*.

The same charge of slovenliness and gross negligence is to be made in regard to the articulation of final unaccented syllables. Most speakers are quite satisfied, even proud, if they can manage to get along all right as far as the accented syllable. The remainder of the word must look out for itself. Thus words like *burrel*, *gravel*, *civil*, *evil*, *confederates*, *circumstances*, *squalor* and *frugal*, are generally given out as *barl*, *gravl*, *civl*, *evl*, *confedrits*, *circumstincis*, *squaler* and *frugl*. While some, as though they were afraid of being correct by accident, persist in giving the *i* its full sound in the word *evil*, which, being an exception, suppresses the vowel in the final syllable, and should be pronounced *evl*.

But enough has been said to substantiate the worst charges

of harshness and slovenliness in our articulation. Surely no one doubts that it is a fact; and it is impossible that any one who loves his mother tongue will think such inaccuracies trifling, and unworthy the attention of earnest men. No defect, not even the slightest, will be by him regarded as trifling. But if it be true that ninety-five out of every hundred of our public speakers and teachers are at fault in this matter, what is to be done? Either we must stand quietly by and see the system of brogues and dialects of the old countries repeat itself in our young nation, or the study of orthoëpy must have a more prominent place in all our schools and colleges. Phonetic spelling should be at once introduced into our Primary Schools, and the whole subject of articulation carefully attended to in the Normal Schools and Colleges. It is not a difficult study, and he is a dull teacher who cannot make it thoroughly interesting. As we would be deemed faithful guardians of the glorious heritage bequeathed us by the fathers of our noble English tongue, let us not any longer be chargeable with errors in practice or with indifference in the work of reform.

POWER.

OVER the wide universe, in all ages and upon all phenomena, have been written two words—*cause* and *effect*. These two words teach us one lesson—the presence of *power*. In every cause that which produces its effect is *power*.

We get our first ideas of power from the exercise of our will, from experiment. A child has no idea of its power to lift anything until it tries and notices the result. With such an initial idea of power, gathered from a first attempt to make known a want or to announce our presence in the world by uttering a cry or by raising a hand, we proceed.

We see in the world around us *change*—the ability to change and the ability to be changed, and as we notice these

things our ideas of power enlarge. Those ideas may arise within ourselves, and be first associated with material things, but with a thinking being they cannot stop there. From this beginning they grow into a conception of the sublime, and into a reverence for the "greater in power and might," as we see that others can do what we cannot, that things are done which our minds cannot comprehend—that the reach of *our* power by no means marks the limit of power.

We see in the short range of our own power the workings of cause and effect. We find in ourselves the efficient cause of certain effects; we reason that the great effects around us, which we cannot comprehend, much less produce, are produced by a greater efficient cause—a mightier *power*. When we have taken into account all the causes and effects of which science is cognizant, there yet remains back of them all a great final, or rather a great initial effect, for which we must allow a great initial cause; and whether, with the materialist, we believe that a physical cause, or, with the Christian, believe it an intellectual, a spiritual, a divine directing and causative presence, we are driven to acknowledge the truth of the Bible statement—to *it*, or "to *Him* all *power* belongeth."

Inasmuch as our conception of power is inseparable from the idea of change in the perceivable or sensible ideas of things, that conception must embrace two great divisions, must think of power as *active* or *passive*, that is, either a principle of acting—a power to make a change, or a principle of receiving—a power to receive a change.

Matter has *passive* power, and is capable of change in its volume or in its position. Of this much at least we are sure. While the materialist says that force is inherent in matter, and while the Christian scientist declares that matter must possess *inertia*—for this is its only power of resistance to pressure, and that therefore force is not inherent in matter, for otherwise, matter being movable, ought to be able to move itself, which it cannot do—while these two opinions are yet in open conflict, one thing is certain, that while in intelligent causes there may be a power which is not exerted, in inani-

mate causes there can be no power which is not exerted. There can be no such thing as a particle of matter in the universe at rest. The powers of the natural world must be ever acting, but the intellect of man may hold its powers in check. Like the great intellect which was at once its author and model, it may rest upon its seventh days, and hallow them.

We get rudimentary ideas of power from considering the changes constantly going on in things material. There we get abundant evidence of passive power, there we get some proofs of active power, for we must always conceive somewhere a power able to *make the change*. And this discloses to us at once the truth that finer ideas of power are to be had in a contemplation of the workings of *mind*. There is nothing absolute or constant in nature save the constant law of change. But through this wilderness of change, mind finds its way. There is an intellectuality which comprehends every change, which watches the vibrations of a molecule, the growth of a hair, or the fall of a sparrow. There is a wisdom which beholds and controls every ultimate of all these changing groups; for there is a law that governs their actions, and where there is a law there is *wisdom*, and where there is wisdom there is a personality. We may call it what we will, it is an *intellect*, a spirit, a thinking, moving *power*. It answers to the Christian's God. Looking from the changes of things material to the operations of the human mind, and then contemplating in the light of reason the operations of that great eternal mind in which was conceived and worked out the design, and in which were laid down the laws of the universe; and again beholding that, constant in the midst of inconstancy, those laws are kept and that design maintained;—looking thus from matter to mind, looking “through nature up to nature's God,” we get the finest, clearest, grandest ideas of power that the mind of man can conceive.

There being but two sorts of action of which we have any idea, viz., *thinking* and *motion*, the powers that produce these actions are the only two divisions of active power. Do

we get our ideas of such powers from matter or from mind, from things material or from things intellectual? It is evident that a material substance can give us no idea of thinking, nor can it furnish us a fundamental, an initial idea of motion. We see a ball rolling through the air, and we know that the ball had power to be moved, but to get the *active*, the true idea of power, of the power that started the motion, we must go back not only to the muscles whose play hurled the ball into space, but back to the palace of the mind, to the throne of the *will*, to the time when the monarch said, "I'll hurl that ball," and when he sent forth the soldiers of his castle—the muscles of his body—to the performance of the task. So any true idea of power that we may have comes not from the consideration of things material, now at rest and now in motion, because, though they declare the exercise of power, they lead us not to the seat of that power, nor to the beginning of its exercise. But when the mind of man falls back on its own operations, when it learns that merely by willing to do so it can move the now quiet limbs of its body, or that by causing those limbs to move as it directs it can move other particles of matter, then it gets a truer idea of power; then it is able to cast its glances through the universe and behold arrows of power in every molecule of solid, of liquid, or of gas, and to see how that every arrow was shot from one bow—how that every active power, in truth, emanates from the Great *Mind* of the ages.

Looking then in upon mind, we find two powers, the power of thinking, or the *understanding*, and the power of volition, or the *will*. The former perceives, analyses; the latter prefers, decides, commands. Without these faculties there can be no action of thought or of motion; without these man has no power.

We do not accept in the widest sense the unqualified statement that the will is the superior and commanding faculty of the soul—that it is the monarch. In a way it is worthy of the name of monarch, for it is a ruler, but it is at best but the head of a limited monarchy. Its seal is necessary to the

validity of any action, to the potency of any command, to the carrying into effect of any design ; but it can only set its seal to bills that have passed the parliament of its understanding. It is a servant, though not a slave of the understanding, but it is the ruler of man's feelings and actions. It cannot prevent a knowledge and a decision, but it can prevent acting upon that decision. It holds the veto power in the house, and speaks the word of command on the field of action. While entirely dependent upon the understanding for power to give effect to its volitions, yet the exercise of *will* is necessary to every action, is necessary to the putting forth of active energy, and still more necessary to the concentration of many energies upon a difficult work. If this be so, then can there, strictly speaking, be such a thing as an *involuntary* action? Can man perform an act which is not at first an emanation from his mind, starting from his understanding, which saw its possibility, flashed to the will, which saw its desirability, and sent forth from thence as a command to those subject powers, whose meat and drink it is to do the bidding of their mental rulers? If man's power belongs to his mind, then is not declaring the action of an intellectual being involuntary. begging the question of force being inherent in physical combination?

Having honored the will with the theory that it is the *sine qua non* of man's physical activity, we now advance the opinion that man's power lies not only chiefly but ultimately, and therefore wholly, in his *understanding*. What can a man do without understanding? What can he not do with it? What does man know how to do that he has not the ability to do? In other words, what action can the compass of man's mind embrace which he cannot *will* to do, and which he cannot perform by those forces which obey the mandate of his will? Man understands the composition of sugar and can make it, but he does not understand and therefore cannot make an ultimate of matter. The *will*, but in a subordinate sense, claims the honor of the name of *power*. The understanding is its superior, and only when it works in accordance

with the dictates of the understanding has its power beyond its own volition—only then has its free volition any result. Canute *willed* to command the sea, but his understanding was not a party to the command. He did not *know how*, and therefore not in terror, but in contempt, the mighty ocean licked his boots. But when the understanding gives its assent, then no matter how difficult the task, “where there’s a *will* there’s a way.”

If the seat of man’s power be his understanding, then the term *liberty* need not be applied beyond man’s understanding. Again we ask, that which a man knows how to do—to think or to cause motion in—what can prevent? The limit of man’s understanding is the limit of his liberty. The boundary of man’s knowledge is the “thus far shalt thou go and no farther” of his *power*.

Dynamite may be *force*, but “knowledge is *power*.” The doctor who tends you in your illness charges five dollars for his medicine and his trouble, and twenty dollars for his *know how*. You may dispute the right of his understanding to claim so large a fee, but you will find it just, for “the court awards it, and the law doth give it.” Let a man’s understanding know how to triumph over the difficulties belonging to the mysteries of a case, or presented by its environments, and what can restrain the *freedom* of his *will* or the liberty of his action. A man may know how to make a brilliant scientific experiment, and at the same time be wanting the necessary apparatus, but that is no limit to his power. He can get the apparatus. Only when he does not know how to get or to make that apparatus is there a limit to his power, and that at once resolves itself into the old fact—a limit to his understanding. Looking back through the years, we fancy we see Newton in his laboratory. He seeks the explanation of certain phenomena, the truth of certain theories. He has the physical ability to sit there day after day and night after night at the toil. But with that ability alone, there may he sit and toil till a Methuselah could live and die, or a patriarchal Rip Van Winkle awake from his long sleep, and his

longing eyes will never behold the Holy Graal of his search, nor his tongue cry the great "*Eureka*" of success.

But Newton has moreover a *will* to work, to search, to toil, to find. But even with this mighty additional, he may will and he may toil till time grows hoar with age, and die, and till the forces which he seeks to explain are gathered at its funeral. His "I work" and "I will" can never for him unlock the mysteries of the universe, but suddenly while he toils and while he wills—while his will awaits instruction and his energies await command, there comes to him "the inspiration of the Almighty which giveth him *understanding*," and the thing is done. Newton's *power* has unlocked the truth, and the world reads in nature's volume the laws of motion.

As we see it, in all that wide range which God has given as the circuit of man's understanding, a circle whose radii have never yet been measured, there are but two things can limit man's power. One is ignorance, and the other is a will whose action is wholly free from trammel. So that to him who wills to do right but knoweth not how, to him it is ignorance; but to him that knoweth to do right and *wills* not to do it. "to him it is sin." While then the decision of the will is perfectly free, its powers, the results of its volitions, depend entirely on the understanding: and only as the will has power to act or not to act, has it influence upon the results of the operations of the understanding.

The decisions are these: That the understanding furnishes the data upon which alone the will can become an efficient cause, producing an effect; that the will is a free power, which wins its highest exaltation, and enjoys its grandest power as a willing servant of a rich and wise understanding. For as understanding may come by experiment, the will may thus at once enrich the understanding of the mind and the power of the man, for the will worketh experiment, and experiment knowledge, and knowledge power; and lastly, that the feelings of the mind can but prompt the will to action. Happy then is he whose feelings prompt his will in accordance with the dictates of a wise understanding, and whose

will uncover its head to receive the commands of that noble queen of the powers that be !

These decisions are strengthened by the thought that we cannot make, but are subject to, *laws*. We can break those laws, but "the way of transgressors is hard." With the great laws of our constitution—the great laws of nature—we must be in sympathy or be inactive. To know those laws and make them the *moti operandi* of our lives is to be powerful ; and only as a man by searching can find out the established laws of nature, is he powerful here. To make, to change, to destroy one such law, to bring its subjects into obedience to another, is not in our power—we have not the understanding. To do that would need the mind that was in Him who "spake and it was done"—the understanding of that God, who "in the beginning created the heavens and the earth." But we can know the existence and workings of such laws—we can use the knowledge. We cannot make midnight follow hard on midday. We cannot span the heavens with a bow proclaiming not a past but a coming storm. We cannot, mid the wild music of a hurricane, cause the grand diapason of nature to roll in thunders through the sky, ere yet the electric flash has cleft the air, and given the signal for the conflict. We can reverse not one of nature's laws. But knowing the laws of the rolling spheres, the laws of light and the laws of electricity, we can foretell the appearance of a luminary in the heavens, we can produce all the colors of the rainbow, we can chain the lightning to our work, and make it draw our loads, light our houses and run our messages. To understand laws is to be powerful.

What then is the conclusion at which this train of thought arrives ? Even this : " Knowledge is *power* ; " " Wisdom is the principal thing ; therefore get wisdom : and with all thy getting get understanding."

" Though I could reach from pole to pole,
And grasp creation in my span,
I must be measured by my soul,
The *mind's* the *power* of the man."

CORRESPONDENCE.

SUGGESTIONS.

To the Editor of V. P. Journal.

DEAR SIR,—Allow me to jot down a few thoughts and suggestions that may be of interest to some of your readers.

“March comes in like a lamb and goes out like a lion.” This may or may not be true. I have watched it for *twelve* years, and in that time it went out nine times as it came in.

For several years the wonderful lights of the north have been watched. The following two facts have been noted. These auroral displays are followed by winds and lowering of the temperature.

“Hot water freezes more quickly than cold water.” This is not true. After careful trial, oft repeated, we announce that cold water will freeze more quickly than warm water.

Will a silver spoon protect canning jars from cracking when hot fruit is poured in at its highest temperature? *Without doubt it will.* The experiment has been made in my presence over a hundred times, and never once did the glass bottle or jar crack. But all cansters know that jars frequently break when hot fruit is suddenly poured in without some previously arranged protection. The truth is evident to the experienced, but is in part inexplicable.

In the last issue of the V. P. JOURNAL one asks who discovered the mode of liberating Antonio from the clutches of Shylock—Portia or Bellario? After reading the work carefully, my conclusion is that it was *Shakespeare*.

Yours truly,

Y.

TORONTO NOTES.

To the Editor of V. P. Journal.

DEAR SIR.—It is a blessed provision of nature that the plucking takes place in the spring before the hot weather comes on. Then there is more opportunity for a lively time

during the long summer evenings. Just at present in Toronto students are too busy cramming for that interesting event for much to be said. There is nothing doing in college circles to report.

The free library is doing a good work. Since the circulating library has opened a real boon is afforded the citizens of this city. The selection of books is excellent, and the conditions of obtaining them very simple. Branches west and north afford greater facilities. A library of this kind is immensely superior to the old-time Mechanics' Institute libraries. In them the selection of books was very limited, owing, I suppose, to the want of funds. Toronto is now well favored in the shape of libraries. There is the lately opened free library, the one at the Parliament buildings, at Osgoode Hall, and the University; between them giving a very good and varied selection—so full, indeed, that one need not fail of obtaining from them almost any information required. Another time I shall attempt to give a fuller account of these libraries.

Our principal excitement of the past month has been the bribery scandal, and the resulting trials. It is much to be hoped that such a foul exhibition will never again be presented to a Canadian audience. It is well, however, to have this plague spot laid open, as thus we may hope for a cure.

The city's semi-centennial is looked forward to with great interest. The gentlemen in charge are admirably fitted for their post, and with the ready co-operation that is given by every citizen, it cannot fail of being a great success. It will certainly be second to nothing of the kind on the continent, unless perhaps the Mardi-gras of New Orleans. That it will be worthy of our city we may well believe.

Yours truly,

ALUMNUS.

Sin has many tools, but a lie is the handle which fits them all.—*Holmes.*

REVIEW TABLE.

DALHOUSIE GAZETTE.—This sprightly little monthly from Halifax speaks out its mind boldly against the unfair disadvantage in which the sciences are placed in the east. Bursaries, scholarships and other rewards have drawn students away into other branches of the Arts Course. Dalhousie has now a Faculty of Law with eight professors and lecturers, a Faculty of Arts with eight professors and three tutors. There is no Faculty of Science, although there are two men of high standing in science, Drs. Lawson and MacGregor.

“THE BIRTH AND GROWTH OF MYTHS,” by Ed. Clodd, F.R.A.S. (Humboldt Library, No. 54). To the curious this is a collection of entrancing stories; to the historian it is a carefully prepared account of the origin of myths; while to all readers it is a book of interest and profit.

AMERICAN LITERATURE.—The Primer published by Houghton, Mifflin & Co., of Boston, is a model of the workmanship of the present year. Excellent paper, clear type, neat binding, systematic arrangement, handsome engravings and thoroughness of treatment, are the leading characteristics. Some of the notes are, however, condensed, and our curiosity is not thoroughly satisfied. As a *primer* it takes high rank, being accurate, attractive and interesting.

THE ACADIAN SCIENTIST.—This bright, cheery little visitor from the east brings us the greetings of the Acadian Science Club. The aim is to *instruct* its readers, and it presents a varied programme in astronomy, botany, entomology, mineralogy. The Society “aims to awaken and foster a more general interest in scientific knowledge, to induce young men and young women to engage in systematic study at home.” Instruction to members is given by correspondence, and through the columns of the *Scientist*. The secretary is A. J. Pineo, B.A., Wolfville, N. S.

TWO JOHN HOPKINS' UNIVERSITY CIRCULARS are on our table, containing programmes of the work of this institution for the present year. Mathematics (Sylvester), Physics (Rowland), Chemistry (Remsen), Biology (Martin), Greek (Gildersleeve), Latin, Languages (modern, ancient and romance), History and Political Science, and Philosophy comprise the various courses. In work mentioned of the fellows we see a notice of a paper on "Local Government in Pennsylvania," by E. R. L. Gould, B.A. (Victoria), and a short abstract of an article on "Selective Absorption" of the sun's rays, by C. H. Koyl, B.A., (Victoria). These two, along with Montgomery, B.Sc. (Victoria), Alexander, B.A. (London), and others, have done credit to Canada in the American University.

ROYAL SOCIETY.—The proceedings and productions of this new society have been published, and are now in the hands of those fortunate enough to be favored with copies. The volume is large, but exceedingly well printed. The general workmanship is of the highest order, including some handsome colored plates. The volume presents a collection of Canadian research and thought never before equalled in a single volume, and the publication will certainly inspire Canadians with new ambitions. The poetic French of Fréchet, Marchand and Le May are here interspersed amid the prose productions of Le Moine, L'Abbé Casgrain and Chauveau. Among English scientists we find prominent the names of Drs. Daniel Wilson, Sterry Hunt, E. Haanel, J. W. Dawson and Robert Bell. It is a production to which we, as Canadians, may point with pride, for it marks the beginning of a new era in original research.

SCIENCE.—This new magazine published at Boston is now in its third volume. The last number on our table presents a varied list of contents. This magazine is intended for specialists. The subjects, as a rule, are not popular, and the treatment is less so. Book reviews, society reports and correspondence, have usurped the columns of comment and criticism. It is a weekly, costing \$5 per year.

LIGHT SCIENCE—THE CAT BATTERY.

NATURE knows no waste. At least scientists have been acting upon this principle. From what we can gather from an article in a late issue of *Electrical Review*, we are on the eve, or rather daybreak, of the brilliant application of a hitherto superfluous article to practical use. The cat has long been waiting—impatiently so at times, we have thought—bemoaning her fate with no uncertain sound; but now, if science speaks aright, she is to be elevated to her true position to shed light upon a darkened world. "Every dog has his day," 'tis said; but soon every cat shall have her day, especially in the night.

This may be another example of *Transformation of Energy*—sound, motion (visible), electricity, light. These are subjects of which we may be justified in making light. From pressure of space, as well as other reasons, we must omit illustrations and prolonged details. Imagination and memory may recall illustrations, and the details are principally concerned with connections, regulators, etc. We clip a paragraph or two for the benefit of young scientists and those interested in "Light Science for Leisure Hours:"

As early as 2306 B.C., Sarcophagus, the Egyptian philosopher, accidentally discovered the electric energy of the cat. Having accidentally sat upon his private cat one evening, while that pampered animal was taking a nap in the arm-chair, he was surprised to find himself enriched with a violently galvanic sensation, together with a sudden desire to stand up and say something. Subsequent investigations led him to the conclusion that the energy of the cat, like latent heat, might be developed by sudden compression. He gave this theory to the world in a celebrated treatise which he wrote that night on the mantel-piece; but eventually died without discovering the true nature of the phenomenon. But after this the domestic Egyptian cat was never sat upon—a fact which gave rise to the modern belief that it was a sacred animal. Two centuries later Obeliskus Mummi, the famous metaphysician of Memphis, while experimenting with two cats suspended from a clothes-line, observed that a strong repulsion existed between them, but was ignorant of its cause. Various other philosophers commented upon cats, and endeavored to explain these phenomena, but it remained for Benjamin Franklin to reveal the long

hidden secret. Franklin's attention was called to the subject in a curious way. To weight his electrical kite, he had suspended to it, by the tail, his cook's cat. A thunder-cloud was passing at the time, and Franklin noticed the hairs of the animal's continuation separate and stand on end. This he knew was a sign of excitement, and he at once concluded that the excitement was electrical.

The results of his subsequent investigations are too well known to need reference; and the Franklin Theory of Cats is that great man's chiefest glory.

With this brief introduction, we come now to the practical elucidation of the principle upon which the Cat Battery works. Cats, according to Tyndall, are either electro-positive or electro-negative. When in the neutral state both fluids are combined, and the most sensitive galvanometer can detect no current. Thus insulated, neither A nor B exhibits either attraction or repulsion for surrounding objects, excepting for a hot stove or a piece of fish. But this affinity, according to the recent investigations of Siemens and Halske, is the result of chemical and not electrical attraction.

Now, however, let us submit electro-positive cat A, and electro-negative cat B, to exciting influences.

Instantly we observe the development of electrical energy—A being strongly positive that he is the better cat, while B is as violently negative. This, as has been proved by the experiments of Prescott, Edison and others, is due to induction; each cat trying to induce the other to believe he isn't afraid.

This electrical state of activity is accompanied by all the well-known electro-static phenomena. The hairs of each cat stand on end, and surrounding objects—such as bootjacks, soap, cough-medicine bottles and crockery—may be attracted with great velocity from distances of 100 to 250 feet.

Cats are absolute non-conductors. This fact was discovered, in 1876, by Gerritt Smith, while vainly endeavoring to conduct a cat out of the coal cellar. It might be urged, therefore, that they had high internal resistance. This is not true. The external resistance is very high, but the internal resistance is never over one Ohm ("ome," or "home," to give German, English and American terms) while in many cases it is less, and is witnessed by the fact that there are 1,317,009 ohmless cats in this city alone. But while the internal resistance is surprisingly low, the intensity is so high that by inductive influence alone two cat elements can maintain a whole neighborhood in a state of electrical excitement. The only drawback to the Cat Battery is found in the wear and tear of material, but as the supply is practically inexhaustible, the telegraph companies may find it to be the most economical in use.

CREATION.

Arnold Guyot, the twin brother of the elder Agassiz in American science, was born in Neuchatel, Switzerland, Sept. 28, 1807. Graduating from the University of Berlin (1835), he pursued his studies for some years at Paris, first in the direction of theology, but was soon diverted to natural history as his life work. From 1839 to 1848 he was a professor in the academy of Neuchatel, and in conjunction with Agassiz, he studied the glaciers and geology of his native country, and elaborated the present "glacial theory," which has wrought such a change in later geological science. In 1848, at the suggestion of Agassiz, who preceded him, he came to America. His first work was the delivery, in Boston, of a series of lectures in French, translated by President Felton, on *The Earth and Man*, which was almost a revelation this side the water, and indeed had hardly been equalled anywhere. For some years he was largely employed by the Smithsonian Institution in preparing the instruments, directions, tables, etc., and organizing generally the system of meteorological observations which in its practical development has made us in this direction the foremost nation of the world. As a lecturer on physical geography before educational institutes, and as the author of "Guyot's Geographies," he totally revolutionized the old-time teaching of that subject in our schools. He was appointed a professor in Princeton in 1855, and was one of the editors-in-chief of *Johnson's Cyclopaedia*. For years he was engaged in physical observations of great value on the Appalachian Mountain System; and in many a hamlet, all through the mountains from Maine to Georgia, his genial presence and kindly words will long be held in cherished remembrance. His geographical labors were crowned with the medal of progress at the Vienna Exposition, 1873. One of the foremost in science and educational progress, he was equally prominent in his simple, earnest Christian faith. He died on the 8th of February last.

"In the beginning of the winter of 1840," so reads the preface to his posthumous volume, "having just finished writing a lecture on the Creation, which was to be a part of a public course of Physical Geography that I was then delivering at Neuchatel, Switzerland, it flashed upon my mind that the outlines I had been tracing, guided by the result of scientific inquiry then available, were precisely those of the grand history given in the first chapter of Genesis. In the same hour I explained this remarkable coincidence to the intelligent audience which it was my privilege to address." For genera-

tions the Christian world had settled down upon the entire literalness of the sacred narrative, so that it was assailed as almost scepticism to question it. But the new interpretation very rapidly grew in favor; it has been held, with slight differences of detail, by such names as Professor Dana, Principal Dawson, President Chalbourne, and may now be safely said to be, "for substance," *the* interpretation given by educated orthodoxy everywhere.

In his little book of 136 large-type pages, Professor Guyot gives us the outlines of his theory and argument as they appeared to him after more than forty years of matured thought. We give his own brief summary as found at the close of the volume, and only the "scientific" half of the parallel columns:

Verses 1, 2.

Matter is not self-existent.

Primitive state of matter. Gas indefinitely diffused.

First Day. First activity of matter.

Gravity. Chemical Action. Concentration of diffused matter into one or more nebulae, appearing as *luminous* spots in the *dark* space of heaven.

Second Day. Division.

The primitive nebula is divided into smaller nebulous masses.

Formation of the visible, lower, starry world.

Third Day. Concentration.

(a) The nebulous masses concentrate into stars. Our sun becomes a *nebulous star*. Formation of the mineral mass of the earth by chemical combination of the solid crust, the ocean and atmosphere. The earth self-luminous; a sun. First appearance of land. Azoic rocks.

(b) First infusorial plants and protophytes.

Fourth Day.

Chemical action subsides. The earth loses its photosphere; sun and moon become visible. First *succession* of day and night, of seasons and years. Differences of climate begin.

Archæan rocks. Protophytes. Protozoans.

Fifth Day.

Plants and animals appear successively in the order of their rank—marine animals, fishes, reptiles and birds. First great display of land plants. Coal beds.

Paleozoic and mesozoic ages.

Sixth Day.

Predominance of mammals; the highest animals. The beasts of the earth, carnivorous; the cattle. Herbivorous animals. Tertiary age.

Creation of man. Quarternary age.

Seventh Day. Sabbath.

No material creation. Introduction of the moral world. Age of man.
—*Literary World.*

FIRE WORSHIPPERS.

ALL that relates to the Parsees—their religion, their customs, and their history—is of the deepest interest, an interest given by and rising from that hoariest antiquity to which they belong. A religion that is of the most ancient of the earth, and one that, although few and unimportant are its adherents to-day, at one time bade fair to be the creed of almost the whole civilized world. It was the belief of Cyrus, Darius, and Xerxes; and, had not the advancing armies of the Persians fallen before the phalanges of the Greek, the religion of the East, the worship of one God, might have flowed over Europe and raised it from the paganism in which it grovelled until the doctrines of Christ, centuries after, spread and were received. Marathon, that greatest battle of the world, preserved the integrity of Greece, but it stayed the purer teaching of Zoroaster from flowing to the West, as it would have done under the empire of the eastern satraps. Long after in the East was Ormuzd worshipped; long did the Persian temples shelter the pure flame of their holy fire; and not until the fierce followers of Mahomet with fire and sword—true fanatics' weapons—conquered them in Arabia, did the followers of Zoroaster dwindle in number and decline in power, till at length, persecuted and oppressed by a power they could not resist but to which they would not bow, they migrated, 1,200 years ago, to India, where, in Bombay and Poonah, the remnants of this ancient faith still linger with their worship.

Zerdusht, or Zoroaster, about whose birth and childhood later superstition has flung an almost impenetrable veil of fable and of myth, was one of those great leaders of men—philosophic and enthusiastic—that only the ardent East seems powerful to produce; one of those men whose belief in their own teaching is so intense and perfect as to convince all

others of its truth. He was born about 500 B.C. (?), and at an early age retired from the world, it is said for thirty years, for meditation and for prayer, during which time he composed those books of his teaching whose fragments remain a priceless treasure to this day, collected in the Zendavesta, the sacred book of the Parsees. His creed was simple and comprehensive, but he doubtless taught with it laws, ceremonies and restrictions, much as were given with that other eastern faith which it so much resembles in many ways; and to these the priestly caste has added much in the succeeding generations. He taught that there was one Almighty Power—a deity existent from all time and for eternity, who created two spirits, Ormuzd and Ahriman, each of whom was also a creating force. Ormuzd was the beneficent and Ahriman the malevolent power, and between them and their followers raged, and has raged since their beginning, a constant warfare. Zoroaster taught that at length Ormuzd should prevail and for a season, before the end of all things, peace should reign on the earth. The great teacher is supposed to have received this knowledge from Ormuzd himself, with whom he was for a space in heaven. He taught that there is a heaven and a hell, and for our actions, good or ill, shall be judged to all a meet reward of happiness or of sorrow, each one upon his merits. Ormuzd told him also to “teach the nations that my light is hidden under all that shines; whenever you turn your face to the light and follow my command, Ahriman [the evil spirit] will be seen to fly. In this world there is nothing superior to light.” Hence it is that fire, though not worshipped by the true Parsee, is held in reverence by all. In their temples the sacred fires, the first bright seed of which was originally brought by Zerdusht from heaven, are constantly kept burning, and from this fact the Parsees have gained the name—a misleading one for the true followers of their prophet—of Fire Worshippers. But with that strange, sad decay that seems the inevitable fate of all religions, corruptions entered their pure faith, until the Monotheistic Parsee, the worshipper of one Almighty Power, degenerating,

became almost universally a mere worshipper of its symbol, with ceremonial and customs that had lost all significance, and prayers whose meaning had long since been forgot.

Until late years, their very priests, who must learn the Zendavesta by heart before they can be admitted to their calling, were ignorant of the old Zend tongue in which their sacred books are written, and, scrupulous to the letter in the observance of their rites, were ignorant entirely of the loftiest teaching of their master, and even of the significance of the ritual they practised. These things now are changed, and the old pure teaching, though with many tedious, sometimes disgusting, ceremonies, is resumed, and the simple creed, "There is one God whom all must worship," is dear to the Parsee's heart not only for its universality, its wide-embracing scope, but from the fact that now for thousands of years, through success and through suffering, through changes of country, home and language, his fathers have adhered to the worshipping of Ormuzd and the honoring of fire.

THE DISTANCE OF THE SUN.

ONE of the most celebrated methods of measuring the distance of the sun is derived from a combination of experiments on the velocity of light with astronomical measurements. This is a method of very great refinement and beauty, and although it does not satisfy all the necessary conditions, it is impossible in this lecture to avoid a brief reference to an investigation so remarkable. The principle of this method is easily enunciated. Though the velocity of light is stupendous, yet it has been possible to measure that velocity by experiment. The best determinations indicate that a ray of light would flash over a distance equal to seven times the circumference of the earth in a single second of time (300,400 kilometres). A ray of light would travel from Southport to London in about the thousandth part of a second. The dimensions of the solar system, are, however, so consider-

able that even a sunbeam requires an appreciable interval of time to span the abyss which separates the earth from the sun. Eight minutes is approximately the duration of the journey. In fact, if the sun were to be suddenly blotted out it would still be seen shining brilliantly for eight minutes after it had really disappeared. Viewed as a means of measuring the sun's distance, it would be necessary to determine this interval accurately to half a second. Does astronomy hold out any prospect of our being able to measure this interval with such nicety? This question is intimately connected with two of the most brilliant discoveries in the annals of astronomy. Although they are well known to everyone who has paid any attention to this science, yet I must refer to them briefly to examine how far they admit of the needful precision. Everyone who has had the opportunity of using an astronomical telescope is familiar with the exquisite system of four moons which grace the great planet Jupiter. These little bodies led two hundred years ago to the discovery of the velocity of light. In their frequent revolutions the little satellites plunge occasionally into the vast and dense shadow thrown by the mighty planet. The sun's light, which had previously rendered the little satellite a glittering point of light, is then cut off, the satellite becomes invisible, and we say that it is eclipsed. This is a most pleasing phenomenon to witness, and as the satellites revolve so rapidly, the eclipses occur with great frequency. From the discussion of previous observations of the satellites we have become aware of the nature of their movements, so that the advent of eclipses can be predicted, and even the time of their occurrence. But the time at which the eclipse takes place is not identical with the moment at which we see the eclipse. There is an old story of the French King who came to the observatory to see an eclipse. Unfortunately his Majesty was late, the eclipse had passed, and when this was explained to him, he wanted to know if it could not be done over again. The only way in which an eclipse could be done over again would be first to view the eclipse from Jupiter himself, and then, with the

quickness of thought, to be transferred to the earth, from whence the very same eclipse would be seen a second time. As long as the little satellite is shining it radiates a stream of light across the vast space between Jupiter and the earth. When the eclipse has commenced, the little orb is no longer luminous, but there is, nevertheless, a long slender stream of light on its way, and until all this has poured into our telescopes we still see the little satellite shining as before. If we could calculate the moment when the eclipse really took place, and if we could observe the moment at which the eclipse is seen, the difference between the two gives the time which the light occupies on the journey. At both extremities of the process there are characteristic sources of uncertainty. The occurrence of the eclipse is not an instantaneous phenomenon. The little satellite is large enough to require an appreciable time in crossing the boundary which defines the shadow, so that the observation of an eclipse is not sufficiently precise to form the basis of an important and accurate measurement. Still greater difficulties accompany the attempt to define the true moment of the occurrence of the eclipse as it would be seen by an observer in the vicinity of the satellite. For this we would require a far more perfect theory of the movements of Jupiter's satellites than is at present attainable. This method of finding the sun's distance holds out no prospect of a result accurate to the one thousandth part of its amount.

PROF. BALL.

R. A. COLEMAN,
Barrister,
Solicitor, Conveyancer, etc.,
No. 6 KING ST. EAST,
TORONTO.